See the Universe

Iwona Stachlewska is an associate professor at the Faculty of Physics, University of Warsaw, the head of the Atmospheric Physics Department, and the leader of the ACTRIS National Facility in Warsaw. A well-known expert in atmospheric remote sensing, researching optical and microphysical properties of various aerosol types (anthropogenic pollution, smog, biomass burning, and pollen), as well as clouds using a wide range of lidar techniques. She builds lidars, develops data evaluation algorithms, and seeks synergies of multi-instrumental approaches combining data from different networks (EARLINET, POLYNET, CLOUDNET, AERONET, PGN, PolandAQO), models (NAAPS, DREAM, HYSPLIT, PALM), and satellites (ADM-Aeolus, Sentinels, CATS, EarthCARE).

Iwona Stachlewska (stationary lidar)

See the Air

Impacts of atmospheric aerosols on urban boundary layer dynamics

Atmospheric aerosols transported over long distances from different parts of the world alter the local composition of the aerosol optical properties and can affect the physical properties of the atmosphere. We have identified two important processes in this regard. First, the presence of aerosols from anthropogenic pollution in the atmosphere can affect the urban boundary layer. This can lead to an increase in particle concentration and particle growth, which in turn, affects the microphysical properties of the boundary layer. Second, the presence of aerosols from biomass burning can affect the urban boundary layer by introducing additional detection channels (extinction, backscatter, etc.) that can be used to study aerosol types and cloud formation. In different environments, such as rural, coastal, and urban areas, the type of aerosol (anthropogenic pollution, biomass burning, desert dust, continental pollution, pollen, etc.) and its impact on the boundary layer can vary significantly. Understanding these processes is crucial for understanding the intensifying weather changes.

Increase of desert dust intrusions over Poland

There is a variety of evidence showing that the climate is changing rapidly. One example is the way that wind patterns are changing and climate zones are shifting. We have been using long-term lidar observations at the Warsaw Observatory Station to capture and quantify the changes in the mineral desert dust intrusions to Poland. We have found that the amount of desert dust coming from the Sahara is increasing and happening more often. The desert dust infusions also last longer and start to appear earlier in the year, even during the winter. This greatly impacts local weather conditions, making the air warmer, fostering cloud formation, and limiting precipitation. This is a crucial finding as the studied process can deepen the drought effect.

Mobile lidar for atmospheric aerosol typing

The mobile Mie-Raman lidar was built to serve space agencies as a provider of ground truth measurements for Earth Observation Missions. The lidar mimics the existing lidars within the pan-European distributed large research infrastructure ACTRIS-ERIC. Still, it also complements them by providing additional detection channels that are unreachable by their capacities. We have implemented several extra channels, including polarization, humidity, and fluorescence observations. This gives a unique opportunity to study aerosol types and cloud formation. In different environments (urban, rural, coastal), we type aerosols (biomass burning, desert dust, continental pollution, pollen, etc.) and study their impact on the boundary layer and cloud formation. Overall, we discover exotic fluorescence signals in the smog-polluted atmosphere containing high levels of elemental carbon. This signals an even higher than the fluorescence caused by the pollution of plants.